CLAIMS

We Claim:

1. A method for delivering a supported bulky ligand metallocene-type catalyst system to a gas or slurry phase polymerization reactor utilizing a carrier solution comprising an antistatic agent and a liquid diluent, wherein the carrier solution serves to flush the supported bulky ligand metallocene-type catalyst system into the reactor.

2. The method of claim 1 wherein the antistatic agent is represented by the formula, $R_mXR'_n$, where R is a branched or straight chain hydrocarbyl group or substituted hydrocarbyl group or groups having one or more carbon atoms, R' is an alkyl hydroxy group, X is at least one heteroatom; and n is such that the formula has no net charge.

3. The method of claim 1 wherein the antistatic agent is a hydroxy containing alkyl tertiary amine.

4. The method of claim 1 wherein the carrier solution is flushed intermittently with the supported bulky ligand metallocene-type catalyst system into the reactor.

5. The method of claim 1 wherein the liquid diluent is one or more of the group consisting of an olefin having from 2 to 20 carbon atoms and a non-polymerizable saturated or unsaturated hydrocarbon.

6. The method of claim 1 wherein the carrier solution and a gas serve to flush the supported bulky ligand metallocene-type catalyst system into the reactor.

7. The method of claim 1 wherein the carrier solution comprises about 0.1 to 5 weight percent of the antistatic agent based on the total weight of the carrier solution.

8. The method of claim 1 wherein the carrier solution is maintained at a temperature above 50 °C at the time of contact with the supported bulky ligand metallocene-type catalyst system.

9. The method of claim 8 wherein the time of contact is less than one minute prior to the supported bulky ligand metallocene-type catalyst system is flushed into the reactor.

10. The method of claim 1 wherein the antistatic agent in the carrier solution is present in amount from about 2 to about 10 weight percent based on the total weight of the supported bulky ligand metallocene-type catalyst system flushed into the reactor at any given time.

11. The method of claim 1 wherein the carrier solution and the supported bulky ligand metallocene-type catalyst system is flushed through a catalyst injection tube into the reactor.

12. The method of claim 1 wherein the carrier solution and the supported bulky ligand metallocene-type catalyst system are flushed continuously through a catalyst injection tube into the reactor.

13. The method of claim 1 wherein the reactor is producing greater than 500 lbs (227 Kg) of polymer per hour.

14. The method of claim 1 wherein reactor is a gas phase reactor having a fluidized bed having a bed weight wherein the carrier solution contains a sufficient amount of an antistatic agent to yield in the range of from 2 to 50 ppm of the antistatic agent based on the bed weight in the reactor.

15. A gas or slurry phase process for polymerizing olefin(s) in a reactor in the presence of a supported bulky ligand metallocene-type catalyst system, wherein the supported bulky ligand metallocene-type catalyst system is introduced to the reactor by a carrier solution, the carrier solution comprising an antistatic agent and a liquid diluent.

16. The process of claim 15 wherein the process is a gas phase process and the reactor is a fluidized bed reactor.

17. The process of claim 10 wherein the antistatic agent is represented by the formula, $R_mXR'_n$, where R is a branched or straight chain hydrocarbyl group or substituted hydrocarbyl group or groups having one or more carbon atoms, R' is an alkyl hydroxy group, X is at least one heteroatom; and n is such that the formula has no net charge.

18. The process of claim 15 wherein the carrier solution comprises about 0.1 to 10 weight percent of the antistatic agent based on the total weight of the carrier solution.

19. The process of claim 15 wherein the carrier solution is introduced into the reactor continuously with the supported bulky ligand metallocene-type catalyst system through an catalyst injection tube into the reactor.

20. The process of claim 15 wherein the carrier solution and a gas are used to introduce the supported bulky ligand metallocene-type catalyst system into the reactor.

21. The process of claim 15 wherein the carrier solution and the supported bulky ligand metallocene-type catalyst system contact each other for less than about one minute prior to entering the reactor.

22. The process of claim 15 wherein the process is producing a polymer product having a melt index less than 1 dg/min and a density greater than 0.920g/cc.

23. The process of claim 22 wherein the polymer product comprises less than 10 ppm of the antistatic agent and the process is producing greater than 500 lbs (227 Kg) of polymer per hour.

24. The process of claim 15 wherein the process further comprises introducing a scavenger to the reactor.

25. A polymerization catalyst composition comprising a supported bulky ligand metallocene-type catalyst system and a carrier solution, the carrier solution comprising an antistatic agent and a liquid diluent.

26. The polymerization catalyst composition of claim 25 wherein the antistatic agent is represented by the formula, $R_mXR'_n$, where R is a branched or straight chain hydrocarbyl group or substituted hydrocarbyl group or groups having one or more carbon atoms, R' is an alkyl hydroxy group, X is O, N, P or S atom or a combination thereof; and n is such that the formula has no net charge.

27. The polymerization catalyst composition of claim 25 wherein the antistatic agent is a hydroxy containing alkyl tertiary amine.

28. The polymerization catalyst composition of claim 25 wherein the carrier solution comprises about 0.1 to 5 weight percent of the antistatic agent based on the total weight of the carrier solution.

29. The polymerization catalyst composition of claim 25 wherein the supported bulky ligand metallocene-type catalyst system comprises an inorganic support material having a particle size in the range of from 10 microns to 80 microns.

30. The polymerization catalyst composition of claim 25 wherein the antistatic agent is present in amount from about 2 to about 10 weight percent based on the total weight of the supported bulky ligand metallocene-type catalyst system.

31. The polymerization catalyst composition of claim 25 wherein the supported bulky ligand metallocene-type catalyst system comprises at least one bulky ligand metallocene-type catalyst compound represented by the formula:

$$(C_5H_{4-d}R_d)\ A_x\ (C_5H_{4-d}R_d)\ M\ Qg\text{-}2$$

wherein M is a Group 4, 5 , 6 transition metal, ($C_5H_{4-d}R_d$) is an unsubstituted or substituted cyclopentadienyl derived bulky ligand bonded to M, each R, which can be the same or different, is hydrogen or a substituent group containing up to 50 non-hydrogen atoms or substituted or unsubstituted hydrocarbyl having from 1 to 30 carbon atoms or combinations thereof , or two or more carbon atoms are joined together to form a part of a substituted or unsubstituted ring or ring system having 4 to 30 carbon atoms, A is one or more of, or a combination of carbon, germanium, silicon, tin, phosphorous or nitrogen atom containing radical bridging two ($C_5H_{4-d}R_d$) rings; each Q which can be the same or different is a hydride, substituted or unsubstituted, linear, cyclic or branched, hydrocarbyl having from 1 to 30 carbon atoms, halogen, alkoxides, aryloxides, amides, phosphides, or any other univalent anionic ligand or combination thereof; also, two Q's together may form an alkylidene ligand or cyclometallated hydrocarbyl ligand or other divalent anionic chelating ligand, where g is an integer corresponding to the formal oxidation state of M, and d is an integer selected from the 0, 1, 2, 3 or 4 and denoting the degree of substitution and x is an integer from 0 to 1.

32. The polymerization catalyst composition of claim 31 wherein x is 1.

33. The polymerization catalyst composition of claim 25 wherein the supported bulky ligand metallocene-type catalyst system comprises alumoxane.

34. The polymerization catalyst composition of claim 25 wherein the polymerization catalyst composition is introduced to a polymerization reactor by the carrier solution, and optionally in the presence of an inert gas.

35. A continuous gas phase process for polymerizing monomer(s) in a reactor, said process comprising the steps of:

a) introducing a recycle stream into the reactor, the recycle stream comprising one or more monomer(s) and;

b) introducing a supported bulky ligand transition metal metallocene-type catalyst system contacted with a carrier solution, the carrier solution comprising an antistatic agent and a liquid diluent, into the reactor;

c) withdrawing the recycle stream from the reactor;

d) cooling the recycle stream;

e) introducing into the reactor additional monomer and additional comonomer to replace the one or more monomer(s) polymerized;

f) reintroducing the recycle stream into the reactor; and

g) withdrawing a polymer product from the reactor.

36. The process of claim 35 wherein the antistatic agent is an alkoxylated tertiary amine.

37. The process of claim 35 wherein the carrier solution comprises about 0.1 to 5 weight percent of the antistatic agent based on the total weight of the carrier solution.

38. The process of claim 35 wherein the polymer product comprises less than 10 ppm of the antistatic agent.

39. The process of claim 35 wherein the process is producing a polymer product having a melt index less than 1 dg/min and a density greater than 0.920g/cc.

40. The process of claim 35 wherein the process is producing a polymer product having a melt index less than 0.75 dg/min and a density greater than 0.925g/cc.

41. The process of claim 35 wherein the process further comprises the step of introducing a scavenger.

42. The process of claim 35 wherein the carrier solution and the supported bulky ligand metallocene-type catalyst system contact each other for less than about 1 minute prior to being introduced to the reactor.

43. The process of claim 35 wherein the supported bulky ligand transition metal metallocene-type catalyst system contacted and carrier solution are introduced into the reactor intermittently.

44. The process of claim 35 wherein the supported bulky ligand transition metal metallocene-type catalyst system is introduced into the reactor with the carrier solution upon start-up or until the desired catalyst productivity, polymer density or melt index are achieved, thereafter the introduction of the carrier solution is halted and the supported bulky ligand transition metal metallocene-type catalyst system is introduced into the reactor by an inert gas.

45. The process of claim 1 wherein the polymer product is withdrawn at a rate greater than 500 lbs (227 Kg) of polymer product per hour.

46. The process of claim 35 wherein the supported bulky ligand metallocene-type catalyst system and the carrier solution are introduced to the reactor through a catalyst feeder tube.

47. The process of claim 35 wherein the process is operating where the recycle stream is divided into a gas phase and a liquid phase.

48. The process of claim 35 wherein the supported bulky ligand metallocene-type catalyst system is a supported bridged bulky ligand metallocene-type catalyst system.

49. The process of claim 35 wherein the time of contact between the supported bulky ligand metallocene-type catalyst system and the carrier solution is less than about 2 seconds prior to the supported bulky ligand metallocene-type catalyst system and carrier solution are introduced into the reactor.

50. A catalyst feeder for use in combination with a reactor vessel having within the reactor vessel a reaction zone, the catalyst feeder comprising a catalyst vessel for containing a polymerization catalyst, the catalyst vessel

connected to a catalyst injection tube for delivering the polymerization catalyst to the reaction zone, the catalyst injection tube being disposed within a support tube that protrudes through the reactor vessel wall, and the catalyst feeder further comprising a means for contacting the polymerization catalyst with a carrier solution comprising an antistatic agent and a liquid diluent prior to the polymerization catalyst entering the reaction zone.

51. The catalyst feeder of claim 50 wherein the means for contacting includes a carrier tube for introducing the carrier solution to the catalyst injection tube.

52. The catalyst feeder of claim 50 wherein the means for contacting is a carrier line for introducing the carrier solution into the support tube and that the catalyst injection tube is recessed sufficiently to provide contact of the polymerization catalyst with the carrier solution prior to their entering the reaction zone.

53. The catalyst feeder of claim 50 wherein the catalyst feeder further comprises a gas line for introducing a gas into the catalyst feeder.

54. The catalyst feeder of claim 53 wherein the means for contacting is at least two delivery lines, one for delivering the antistatic agent and one for delivering the liquid diluent.

55. The catalyst feeder of claim 54 wherein the at least two delivery lines enter a mixing vessel where the antistatic agent and liquid diluent are combined to form the carrier solution.

56. The catalyst feeder of claim 54 wherein at least one of the delivery lines is connected to the other resulting in the mixing of the antistatic agent and liquid diluent in at least one of the delivery lines.

57. The catalyst feeder of claim 50 wherein catalyst feeder further comprises a means for maintaining the carrier solution at a temperature above 50 °C.

58. The catalyst feeder of claim 50 wherein catalyst feeder further comprises a means for introducing the carrier solution into the reactor intermittently.

59. The catalyst feeder of claim 50 wherein the polymerization catalyst is a supported bulky ligand metallocene-type catalyst system and the carrier solution comprising from about 2 to 10 weight percent antistatic agent based on the total weight of the supported bulky ligand metallocene-type catalyst system.

60. The catalyst feeder of claim 50 wherein the reactor vessel is a fluidized bed gas phase reactor.

61. A continuous gas phase fluidized bed process for polymerizing olefins(s) in the presence of a supported bulky ligand metallocene-type catalyst system in a reactor vessel, the supported bulky ligand metallocene-type catalyst system contacted with a carrier solution comprising an antistatic agent are introduced into the reactor vessel through a catalyst injection tube, wherein the process comprises the step of withdrawing greater than 500 lbs (227 Kg) of a polymer product per hour, the polymer product having a melt index less than 1 dg/min, a density greater than 0.920g/cc and containing less than 10 ppm of the antistatic agent.

62. The process of claim 61 wherein the polymer product has a melt index less than 1 dg/min and a density greater than 0.925 g/cc.

63. The process of claim 62 wherein the process comprises the step of withdrawing greater than 25,000 lbs (90,900 Kg) of polymer product per hour.

64. The process of claim 61 wherein the polymer product has an I_{21}/I_2 of greater than 30, and a density greater than 0.910 g/cc.

65. A continuous process for polymerizing olefins(s) in the presence of a polymerization catalyst composition in a reaction zone within a

polymerization reactor, the polymerization catalyst composition comprising a supported bulky ligand metallocene-type catalyst system and a carrier solution comprising an antistatic agent and a liquid diluent, wherein the supported bulky ligand metallocene-type catalyst system contacts the carrier solution for less than one minute prior to the polymerization catalyst composition entering the reaction zone.

66. The process of claim 65 wherein the supported bulky ligand metallocene-type catalyst system contacts the carrier solution for less than 30 seconds prior to the polymerization catalyst composition entering the reaction zone.

67. The process of claim 65 wherein the supported bulky ligand metallocene-type catalyst system contacts the carrier solution for less than two seconds prior to the polymerization catalyst composition entering the reaction zone.

68. The process of claim 65 wherein the supported bulky ligand metallocene-type catalyst system contacts the carrier solution intermittently.

69. The process of claim 65 wherein the process is a gas phase process and the polymerization reactor is a fluidized bed reactor.

70. The process of claim 65 wherein the polymerization catalyst composition enters the reaction zone through a catalyst injection tube and the process is producing greater than 500 lbs (227Kg) of a polymer product per hour.

71. The process of claim 65 wherein the process is producing greater than 1000 lbs (455 Kg) of a polymer product per hour.

72. The process of claim 65 wherein the process is producing greater than 10,000 lbs (4540 Kg) of a polymer product per hour.

73. The process of claim 65 wherein the process is producing greater than 25,000 lbs (11,300 Kg) of a polymer product per hour.

74. The process of claim 72 wherein the polymer product has a density greater than 0.900 g/cc.

75. The process of claim 73 wherein the polymer product has a density greater than 0.920 g/cc.

76. The process of claim 75 wherein the polymer product has a melt index less than 1 dg/min.

77. The process of claim 72 wherein the polymer product has a density greater than 0.925 g/cc and a melt index less than 0.75 dg/min.

78. The process of claim 77 wherein the polymer product has an I_{21}/I_2 greater than 30.

79. The process of claim 73 wherein the polymer product has a density greater than 0.925 g/cc and the I_{21}/I_2 is greater than 60.

80. The process of claim 65 wherein the process is producing greater than 50,000 lbs (22,700 Kg) of a polymer product per hour and the polymer product having a density greater than 0.920 g/cc and a I_{21}/I_2 greater than 40.